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ABSTRACT

This study examined the prediction of reading achievement for 144 second-, third-, and fourth-grade children in classrooms differing in program openness. Intercorrelations of nine cognitive and personality variables were factor analyzed, and four components representing creativity, conceptual tempo, attitude, and intellectuality were extracted. Reading achievement was regressed on these four composite indices plus chronological age, within each of three levels of classroom openness. Comparisons of regression weights indicated that creativity, conceptual tempo, and age decreased in their ability to predict reading achievement, as openness decreased. In contrast, the intellectual factor was increasingly predictive of reading achivement, as openness decreased. (Author)

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Prediction of Reading Achievement as a Function of Classroom Openness

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Abstract

This study examined the prediction of reading achievement for 144 second, third, and fourth grade children in classrooms differing in program openness. Intercorrelations among nine cognitive and personality variables were factor analyzed and four components representing creativity, conceptual tempo, attitude and intellectuality, were extracted. Reading achievement was regressed on these four composite indices plus chronological age within each of three levels of classroom openness. Comparison of regression weights indicated that creativity, conceptual tempo, and age decreased in their ability to predict reading achievement as openness decreased. In contrast, the intellectual factor was increasingly predictive of reading achievement as openness decreased.

Given the proliferation of "open" educational programs in recent years, it is somewhat difficult to reconcile the lack of experimental interest in the topic with the enthusiasm of educational practitioners. Moreover, the little available literature on the topic has been typically restricted to a fairly straightforward comparison of mean differences on selected outcome variables for students in classrooms differing in program openness. With respect to the prediction of reading achievement such research has led to highly variable findings, some studies reporting mean differences (Wright, 1975), other studies failing to find mean differences (Trotta, 1973; Tuckman, Cochran, and Travers, Note 1), and still others reporting an interaction of openness and certain student characteristics as age and intelligence (Gardner, 1966; Ward and Barcher, 1975).

It has been suggested that evaluation of child outcomes in open educational settings is but one step in the assessment of such programs (Bussis and Chittenden, 1969). Specifically, these authors have called for "further research on learning as it occurs in an open classroom and on the process of educational change." Studies which compare means on reading achievement are of limited value in this regard. If no mean differences are found, we cannot conclude that the educational programs are the same, but only that they are equally effective. That is, we cannot determine <u>how</u> the programs differ or infer much about the nature of their operation. One approach to the determination of process differences between open and traditional classrooms is by direct observation of teacher and child behavior, either with standard observation systems such as

Flanders Interaction Analysis (Wright, 1975) or with instruments especially constructed for the purpose (Barcher and Ward, Note 2). An alternate approach is to examine the relationships among the correlates of reading achievement as a function of educational programs, the fundamental assumption being that differences in the patterns of predictive relationships reflect the differential effects of classroom experience, irrespective of the magnitude of these effects.

The specific purpose of the present study was to examine the pattern of relationships for predicting reading achievement from a set of cognitive and personality variables. This was accomplished by, first, factor analyzing the correlation matrix for the entire sample and then calculating factor scores for each subject. Reading achievement was then regressed on four composite variables (i.e., factor scores) plus chronological age within each of three levels of classroom openness.

Method

Subjects

The total sample was composed of three groups of children, each group being drawn from five second, third and fourth grade classrooms representing different levels of program openness. Group HO (High Open) consisted of 32 children (19 boys, 13 girls) from a campus laboratory school which had offered an open program for four years at the time of the study. This program was judged to be extremely open in nature on the basis of teachers' scores on the Dimensions of Schooling questionnaire (DISC). The DISC is a 28 item teacher self-report instrument designed for purpose of quantifying

program openness (Traub, Weiss, Fisher and Musella, 1972). Groups MO (Moderately Open) and T (Traditional) were both drawn from a public elementary school. This school offers two quite distinct programs, one based on the open classroom model, the other considered quite traditional. The 55 subjects (30 boys, 25 girls) in group MO were selected from five classrooms in the open program. The 57 subjects (30 boys, 27 girls) in Group T came from rooms in the traditional program in the same school. There was no overlap of DISC scores for the three experimental groups.

Instruments

Reading achievement was assessed by the Metropolitan Achievement Test and reading comprehension grade equivalents served as the dependent variable.

Two measures of intelligence were administered, the Peabody Picture Vocabulary Test and a battery of Piagetian tasks assembled by the author. This battery included 30 questions which tested for conservation of length, weight, mass and volume; area quasi-conservation; class inclusion, conservation of hierarchy and hierarchical reclassification.

Since proponents of open education claim that open classroom experience benefits children's affective development, several measures of personality were included in this study: the Piers-Harris Self-Concept Test, the Preschool and Primary Nowicki-Strickland Internal-External Control Scale, the Matching Familiar Figures Test, and a 40 item attitude toward school scale developed by the author.

Student creativity was assessed using two figural and two verbal tests. The "circle game" (figural) and "uses" (verbal) subtests of

the Torrance Tests of Creative Thinking (Torrance, 1966) and the "Picture meaning" (figural) and "similarities" (verbal) tests (Wallach and Kogan, 1965) were employed.

Procedure

The following instruments were group administered, either in the schools' cafeteria or individual classrooms: the reading test, the circle game (creativity), locus of control, and attitude toward school. The remaining instruments required individual administration. These included: the Peabody Picture Vocabulary Test, conceptual tempo (MFF), the creativity tests other than the circle game, and the Piagetian tasks.

Results and Discussion

The reading criterion was regressed on the set of predictor variables within each of the three openness groups and regression equations were subsequently compared across groups. The first step of the data analysis was to reduce the dimensionality of the set of predictor variables in order to overcome the problem of multicollinearity and also to simplify comparison of the three regression equations. The nine predictor variables were intercorrelated across the total sample of subjects (N = 144), and the principal components of the correlation matrix were extracted. Results of the component analysis indicated that four factors, which accounted for about 70% of the variance, were sufficient to explain the interrelationships among the predictor variables. The decision to retain only four factors was based on the eigenvalue greater than unity criterion. The four principal components retained in the analysis were then rotated to a terminal solution according to Kaiser's normalized

varimax criterion. Factor loadings obtained from the truncated component solution are shown in Table 1, along with the percentage of total variance accounted for by each component.

As is clear from Table 1, a surprisingly unambiguous factor structure emerged from the data. The two creativity measures, verbal and figural, correlated highly and about equally with the first component. Thus, Factor I was interpreted as representing a composite index of creativity. Factor II appeared to represent conceptual tempo; latency on the Matching Familiar Figures Task correlated positively with Factor II and number of errors on this task correlated negatively. High scores on Factor II, therefore, indicate a reflective style while low scores indicate an impulsive style. Factor III correlated with self concept and attitude toward school; high scores on this factor represent a favorable attitude toward school and self. Finally, Factor IV represented a conglomerate of cognitive measures (IQ, score on Piagetian tasks, and locus of control). Factor IV was rather loosely labeled an intellectual component.

Four composite variables, as defined above, were generated by applying respective factor-estimate coefficients to subjects' standardized scores on each variable in each of the three openness groups. Reading achievement was regressed on the four composite indices and chronological age within each level of classroom openness. Standardized regression coefficients associated with each factor are presented in Table 2 as a function of classroom openness. Table 2 also shows the overall magnitude of each multiple correlation coefficient and the percentage of variance, corrected for "shrinkage," in reading achievement accounted for by the five predictors (McNemar, 1969).

Examination of the multiple correlation coefficients (and corrected $\underline{R}^2$ values) reported in Table 2 shows that reading achievement is somewhat less predictable as classroom openness decreases. Multiple $\underline{R}$ values decreased from .645 to .501, while the (corrected) percentage of variance explained by linear regression decreased from 33% to 18%. Inspection of Table 2 also shows that several trends in the regression weights are noteworthy. First of all, creativity, conceptual tempo, and age decrease in relatedness to reading achievement as classrooms become more traditional. In contrast, reading achievement is increasingly tied to the intellectual factor as classroom openness decreases. The attitude factor evidenced the only uninterpretable trend across groups; a favorable attitude toward school and a positive self-concept are most conducive to achievement under the condition of moderate classroom openness.

Regression weights associated with the creativity factor decreased from .133 to .018 as openness decreased. This implies that, regardless of the effect of open education on students' creativity per se, creativity is a more important factor entering into the prediction of reading achievement in open classrooms. One possible explanation for this finding is that reading achievement depends to some extent on the same cognitive processes that are typically tapped by tests of creativity. If an open learning environment does encourage creativity by allowing children to approach materials in novel and idiosyncratic ways, creativity would be more relevant to reading achievement in these settings. Alternately, to the extent that traditional classroom structure constrains creative thought by failing to provide appropriate opportunities and experiences, creativity must surely become increasingly irrelevant to reading

achievement.

A similar line of reasoning extends to the relationships between conceptual tempo and reading achievement. Relative weights associated with the reflective-impulsive dimension decreased from .249 to .102 as openness decreased; a reflective response style, for example is most related to reading achievement in highly open classrooms. This is not to say that open education leads to more reflective response styles, but rather that open education allows differences in response styles to emerge and consequently influence other behavior (i.e., reading achievement).

In addition to creativity and conceptual tempo, comparison of regression coefficients among the three levels of classroom openness reveals an interesting interplay between the intellectual factor and age. Whereas maturation (age) is the best predictor of reading level at the highest level of openness, intellectuality becomes increasingly more relevant to reading and the remaining factors decrease markedly in importance as openness decreases. The intellectual factor weights increased from .239 to .432 and the weights associated with age decreased from .493 to .160 as openness decreased. This pattern of relationships calls into question the common notion that intelligence is the best single predictor of academic achievement (Lavin, 1965). Rather, classroom openness interacts with intelligence in the prediction of reading achievement--the intellectual factor is the best single predictor of reading achievement only in the traditional classroom situation. As is described above, other factors are of considerable importance to reading achievement in open classrooms.

The change in age coefficients may reflect the possibility that in open classrooms, especially in the case of multi-age grading, older students are simply expected to read better than younger students. In open classrooms there is less reliance on formal evaluation, and the students are permitted to learn at their own pace. In contrast, given the greater reliance of traditional teachers on standardized tests, students are more likely to be encouraged to read as well as ability allows. The evidence suggests that open students read at a level closer to that expected on the basis of their chronological age, but traditional students achieve a reading level which is closer to their intellectual potential.

A more obvious distinction between open and traditional classrooms is made if it can be shown that one method of instruction leads to higher reading achievement, higher creativity, and more reflective response styles. Although the present findings do not distinguish methods of instruction on this more rigorous criterion, they do suggest that the open classroom provides an atmosphere in which certain factors of intuitive importance to educators actually relate to measurable learning outcomes.

Reference Notes

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Table 1

Rotated Matrix of Factor Loadings and Percentage of Variance Explained by Each Principal Component

Variable	Factor			
	I	II	III	IV
Creativity - Figural	.913	-.014	-.049	-.131
Creativity - Verbal	.908	-.038	-.088	-.130
MFF - Latency	-.086	.880	-.081	.114
MFF - Errors	-.044	-.838	-.065	.275
Self Concept	.092	.051	.860	-.157
Attitude toward School	-.306	-.094	.754	.120
PPVT IQ	-.032	.122	.291	.727
Piagetian Tasks	-.105	-.131	-.061	.609
Locus of Control-Externality	.147	.085	.218	-.666
% Variance	24.72	18.19	15.77	11.37

Table 2

Standardized Regression Coefficients for Prediction of Reading Achievement from Five Factors as a Function of Classroom Openness

Factor	Degree of Classroom Openness		
	High (n = 32)	Moderate (n = 55)	Low (n = 57)
Creativity (Verbal-Figural)	.133	.099	.018
Conceptual Tempo (Reflective-Impulsive)	.249	.107	.102
Attitude (School and Self)	.125	.202	-.062
Intellectuality	.239	.400	.432
Age	.493	.229	.160
R:	.645*	.585*	.501*
Shrunken R^2:	.330	.276	.178

*p<.05